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Part 4

NOTES ON MALAYAN DIPTEROCARPACEÆ—III

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These notes are a third contribution to the systematic study of the *Dipterocarpaceae* of the Malayan region.*

Nine species of *Shorea* and three of *Hopea* are included in this paper—the controlling factors in their selection being the urgency of the problem involved, the quality and quantity of material available, and an endeavour to follow as systematic a sequence as possible. Commencing with *Shorea guiso* (a species requiring considerable study), I have discussed three other related species—*S. collina*, *S. ochrophloia*, and *S. Foxworthyi*. Next I have given my arguments supporting the change in botanical name of a tree, hitherto known in the Malay Peninsula as *Hopea dealbata*, to *H. Helferi*. *H. apiculata* (a recently discovered species) has then been described and figured in some detail because of its botanical interest, and along with it is included *H. resinosa*, the only other representative of the *Pierrea* group known from the Malay Peninsula. *Shorea bentongensis*, the first member of the section *Anthoshorea* on which I have had occasion to publish notes, must stand alone in this paper as my manuscript on related species is not yet complete.

From Borneo, thanks to the efforts of the Forest Officers in British North Borneo, Sarawak, and Brunei, a large amount of excellent herbarium material of dipterocarps has accumulated since 1932. Much of this material is representative of undescribed, or little-known, species which require study and classification. A beginning is made in this paper with the descriptions of the new species *Shorea inaequilateralis*, *S. albida*, *S. ochracea*, and *S. scabrida*.

In this number, as in number 2 of this series, the citation of literature is more complete than in my first paper, because it seems desirable to record all the literature consulted, whether it be essential to the argument or not.

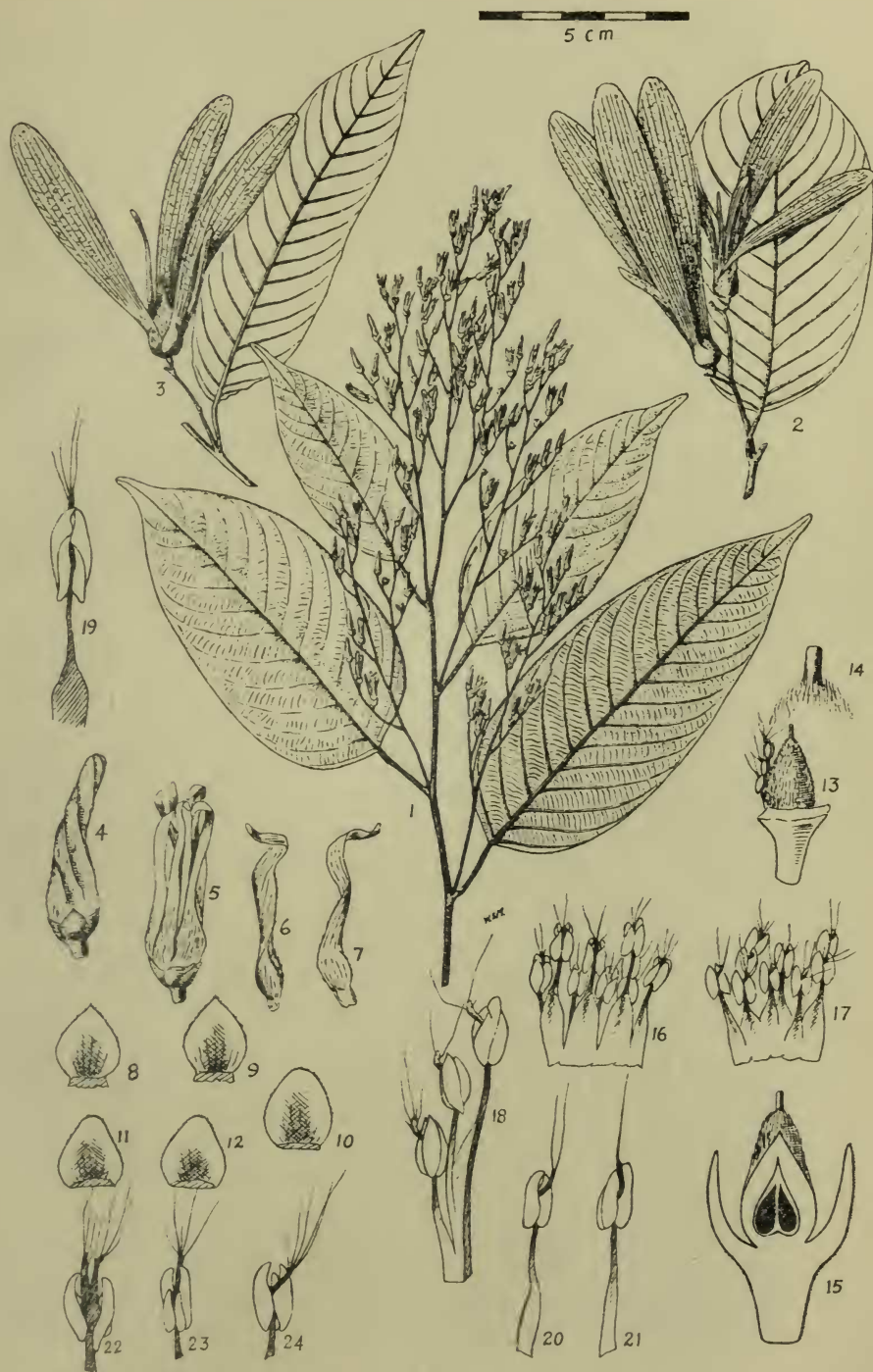
* For previous papers see *Gdns. Bull. S.S.*, Vol. VII, pp. 129–159 (1933), and Vol. VIII, pp. 1–40 (1934).

The concluding paragraph of the notes on each species is addressed, in particular, to forest officers.

I have, once more, to express my appreciation of the assistance willingly accorded by numerous institutions, botanists, and forest officers. In addition to those mentioned in the introduction to my last paper in this series I am particularly grateful to the Conservator of Forests, British North Borneo and the Conservator of Forests, Sarawak, for the loan of their entire collections of *Dipterocarpaceae*.

Shorea guiso (Blanco) Bl., Mus. Bot. Lugd.-Bat. 2: 34 (1852); Vidal, Sinopsis Atlas 15, tab. 15, f.C (1883); Brandis in Journ. Linn. Soc. 31: 89 (1895); Perk., Frag. Fl. Philip. 23 (1904); Merr. in Philip. Journ. Sci. 1, Suppl: 98 (1906), Spp. Blanco.: 270 (1918), et Enum. Philip. Fl. Pl. 3: 97 (1923); Foxw. in Philip. Journ. Sci. (Bot.) 2: 384 (1907), 4: 509 (1909), 6: 272 (1911), & 13: 191 (1918), et Mal. For. Rec. 10: 175 (1932) in obs.; Whitford in Philip. Bur. Forest. Bull. 10: 71, tab. 74 & 75 (1911); V. Sl. ex Merr., Univ. Calif. Pub. Bot. 15 (Pl. Elmer. Born.): 203 (1929); Desch in Mal. Forester 4: 29 (1935), in nota: *Mocanera guiso* Blanco, Fl. Filip. 449 (1837): *Euphoria malaanonan* Blanco, l.c. 286, non *Shorea melaanonan* Bl.: *Dipterocarpus guiso* Blanco, op. cit. ed. 2: 313 (1845), et ed. 3, 2: 215 (1878): "*Euphoria* vel *Nephelium*" Blanco, op. cit. ed. 2: 200 (1845), et ed. 3, 2: 9 (1878): *Anisoptera guiso* A. DC., Prodr. 16, 2: 616 (1868): *Shorea robusta* F.-Vill., Novis. App. 21 (1880) non Gært. n.: *Shorea vulgaris* Lanessan, Pl. Utiles Col. Fr. 301 (1886); Pierre, Fl. For. Cochinch. Fasc. 15, tab. 232 (1890); Brandis in l.c. 81, tab. 2, 15 & 16 (1895); Guérin ex Lecomte Fl. Gén. Indo-chine 1: 380 (1910): *Shorea Vidaliana* Brandis in l.c. 83 (1895): *Shorea Warburghii* Perk. l.c. 23 (1904) non Gilg.: *Shorea scrobiculata* Foxw. in Philip. Journ. Sci. Bot. 13: 192 (1918) non Burck: *Shorea longipetala* Foxw., Mal. For. Rec. 10: 174, tab. 13 (1932); Sym. apud Desch in l.c. 28 & 29 (1935). Plate XVI.

Foxworthy has described this species under the name of *S. longipetala* but the following additional information may be helpful:—the *leaves* vary in size and shape through a much wider range than that described; there may be as many as 26 pairs of *main nerves*; the *petioles* are normally over 1.0 cm. long; the *flowers* may be almost sessile; the *stamens* vary in number (in the flowers I have examined) from 20 to 41; and the *cilia* on the appendages from 1 to



Shorea guiso (Bleco.) Bl.

8. The *fruits*, of which I have seen only one really mature collection (C.F. 9508), may be described as follows:—stalk 1.5 mm. long, stellate-puberulous; calyx lobes swollen and woody at the base, closely appressed to one another, enclosing rather less than half of the nut, puberulous; three large wings linear-spathulate, 6.0–7.0 cm. $\times$ 0.9–1.2 cm., about 8-nerved; two small wings linear, about 3.5 cm. $\times$ 0.2 cm., 3 to 5-nerved; nut about 1.3 cm. $\times$ 0.8 cm., sericeous-tawny tomentose, terminated by a tomentose beak which is 4.0 mm. long.

This species was first described by Blanco from Philippine material in 1837 under the name of *Mocanera guiso*. This name he altered to *Dipterocarpus guiso* in subsequent editions of his "Flora de Filipinas". Under the names *Euphoria malaanonan* and "*Euphoria* or *Nephelium*" Blanco described sterile, galled collections of the same plant. Fernandez-Villar (1880) considered this to be *Shorea robusta* Gærtn.—an error rectified by Merrill in 1918 when he established the true identity of *Euphoria malaanonan* in his "Species Blancoanæ".

The combination *Shorea guiso* was first made by Blume in 1852. In 1868 De Candolle placed the species in *Anisoptera*, but, in 1895, Brandis again reverted to *Shorea*, to which genus it obviously belongs.

In 1886 this species was discovered in lower Cochinchina and named *Shorea vulgaris* by Lanessan. Pierre described and figured the species in some detail in his Forest Flora of Cochinchina in 1890. His descriptions and figure are slightly inaccurate in some respects (notably in the large number of hairs on the appendage) but examination of the Kew sheets of Pierre's type specimen (1727) convince me that it is conspecific with *Shorea guiso*.

Later Philippine collections were described as *Shorea Vidaliana* by Brandis in 1895, and referred to *Shorea Warburghii* Gilg. by Perkins in 1904. I have not had the opportunity of examining these collections, but I have included them in my synonymy on the authority of Merrill and other Philippine botanists. Another Philippine collection (22712) was referred to *Shorea scrobiculata* Burck by Foxworthy in 1918. I am in agreement with Merrill who has identified it with *Shorea guiso*.

Our collections from the Peninsula date from 1918 and were described by Foxworthy in 1932 as *Shorea longipetala*. At the time Foxworthy was aware of the close affinity of *S. longipetala* and *S. guiso*, and suggested that reduction might be necessary. *Shorea guiso* was collected

in British North Borneo by Elmer in 1923 (*vide* V. Sl. ex Merr., *Pl. Elmer. Born.*) and in Peninsular Siam by Foxworthy in 1930. The latter collections are here recorded for the first time.

Collections examined:—

COCHINCHINA: Pierre 1727 (Auth. spec. of *Shorea vulgaris* Lanessan).

SIAM: S'pore 24236 & 27239.

MALAY PENINSULA:

KEDAH: C.F. 17788, 27379, & 27400.

KELANTAN: C.F. 32723, 32731, 32732, 32830, 33263, 33264, 33406, & 33452.

PERAK: C.F. 0132, 0138, 8334, 10258, 10354, 10424, 11596, 16703, 25443, 25747, 29018, 29019, 29875, 30741, & 30802.

DINDINGS: C.F. 16802 & 27843.

TRENGGANU: C.F. 26929 & 26933.

PAHANG: C.F. 1277, 4503 (Auth. spec. of *Shorea longipetala* Foxw.), 4856, 5447, 7932, 9508, 13797, 15627, 17242, 17334, 23361, 26033, 26035, 27994, 28324, 29378, 29961, & 37316.

SELANGOR: C.F. 12065, 23086, 23329, 24203, 24245, 25168, 33556, & 33895.

NEGRI SEMBILAN: C.F. 12837, 12849, 18199, 20135, 24304, & 26614.

MALACCA: C.F. 25286.

BRITISH NORTH BORNEO: C.F. 38836 (S.H. No. 4460).

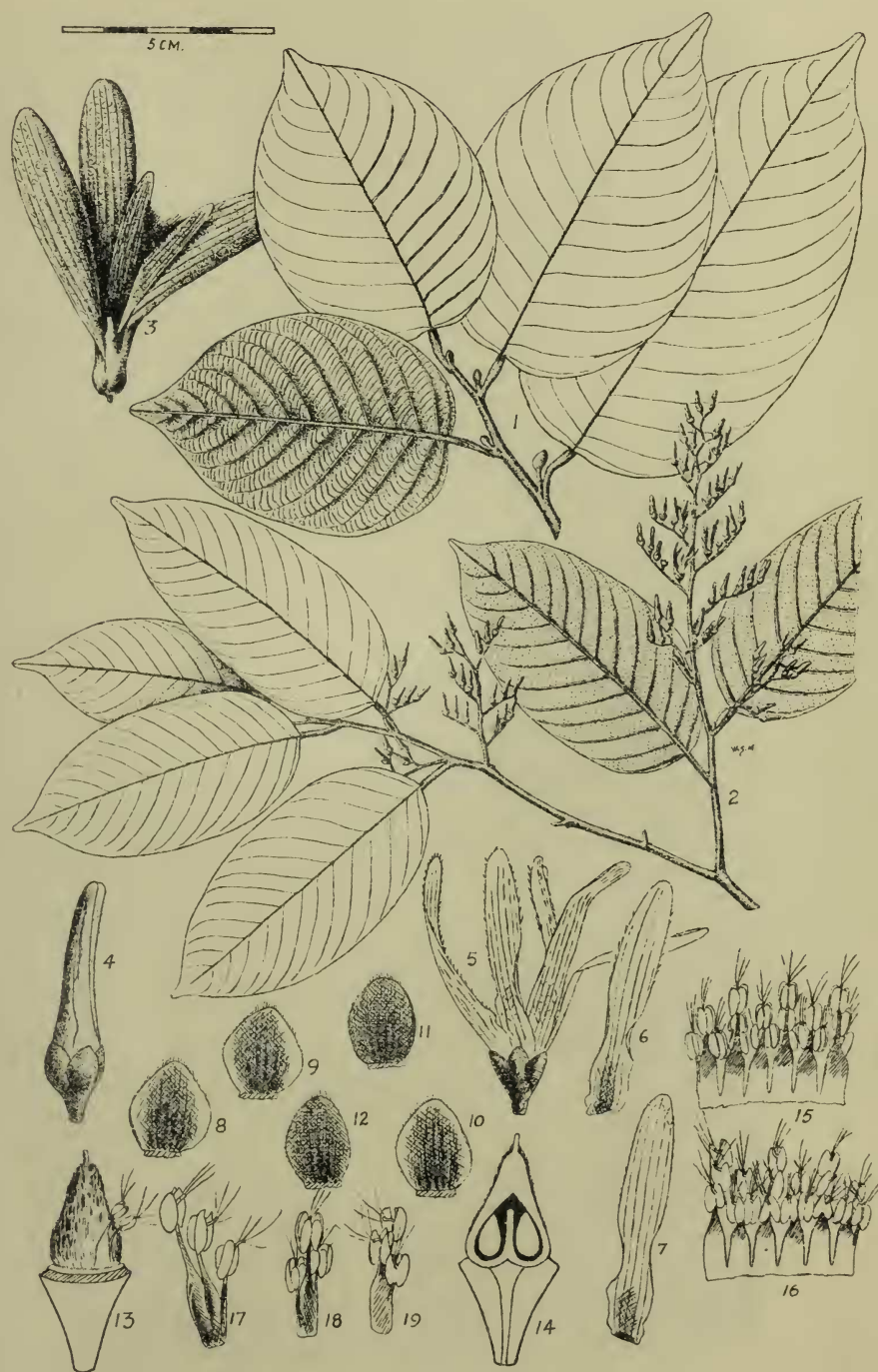
PHILIPPINES: Bur. Sc. Philip. 2865, 7344 & other colls. at Kew, 11773, 27136, 27373, & 29063. Merr. Spp. Blanco. no. 407.

The tree, for which the preferred name of *membatu* is given in our list of Botanical Equivalents, was described as *Shorea longipetala* in 1932. This species is here shown to be the same as *Shorea guiso* of the Philippines and *Shorea vulgaris* of Cochinchina. The oldest name *Shorea guiso* must, in future, be adopted for our species, which, it is interesting to note, extends from Cochinchina through Siam, the Malay Peninsula, and Borneo, to the Philippines.

Shorea ochrophloia E. J. Strugnell (Ms.) **sp. nov.**; Sym., apud Desch in Mal. Forester 4: 28, nomen. Plate XVII.

Ab affine *S. guiso* (Blco.) Bl., ramulis crassioribus, foliis tomentosius crassioribus, paniculis densioribus facile distinguenda.

Branchlets densely fulvous stellate-tomentose when young; later glabrescent, black. *Leaves* ovate, elliptic-ovate,



Shorea ochrophloia E. J. S. ex Sym.

to ovate-oblong, usually shortly blunt-or mucronate-acuminate at the apex, rounded or subcordate at the base, margins subrevolute, average size about 7.0 cm. $\times$ 5.0 cm. but very variable, glabrous (except on midrib) and usually drying yellow- or red-brown above, fulvous tomentose on the nerves beneath; midrib slightly depressed and tomentose above, strongly elevate and stellate-tomentose beneath; main nerves 13 to 17 pairs, slightly depressed above, strongly elevate and stellate-hairy beneath; nervules joining the main nerves in parallel curved lines, inconspicuous above, conspicuous and stellate-hairy beneath; petioles terete, thicker in the upper portion, 0.8–2.0 cm. long, fulvous tomentose; stipules oblong-obtuse, subfalcate, 6.0 mm. $\times$ 3.0 mm., tomentose on both surfaces, caducous. *Panicles* axillary and terminal, lax; main axis usually less than 5.0 cm. long, fulvous tomentose; ultimate branchlets about 5.0 mm. apart, 1.0–2.0 cm. long, grey tomentose, each bearing 2 to 6 second flowers. *Flowers* 2.0–3.0 mm. apart, elongate in bud, about 8.0 mm. long (including the pedicel); pedicel 1.0 mm. long, grey tomentose. *Sepals* ovate-obtuse, subequal, densely tomentose outside, glabrous inside. *Petals* linear, pale-sericeous tomentose outside, "creamy-white with a purple-red patch inside at the base" (Symington, C.F. 30735), falling separately. *Stamens* 26 to 30 (in flowers examined), of three heights, arranged in 3's (*vide* plate XVII, 15 & 16); anthers elliptic-oblong, posterior cells slightly smaller than the anterior; filaments 2 to 4 times as long as anthers, broad at the base, narrow in the upper half; appendage to connective less than half the length of the anther, blunt, becoming reflexed, with 3 to 5 (usually 3) fine hairs. *Ovary* ovate, narrowed above, densely sericeous tomentose; style short, cylindric, glabrous; stigma not enlarged. *Fruit*—a 5-winged nut: stalk 2.0 mm. long, stellate-puberulous; bases of accrescent calyx wings thickened and woody, enclosing one half of the nut, stellate-puberulous; three outer wings linear-spathulate, narrowed to the base, 5.0–7.0 cm. long $\times$ 1.3–1.5 cm. broad, 7 to 8-nerved, puberulous in the lower portions, red-brown; two inner wings smaller, linear, about 4.0 cm. $\times$ 0.5 cm., 5 to 6-nerved; nut ovate, rostellate, about 1.5 cm. $\times$.7 cm., pale tomentose; rostellum up to 5.0 mm. long, densely tomentose.

Shorea ochrophloia is a typical member of the section *Eushorea*. In flower characters it is almost indistinguishable from *Shorea guiso* (Blco.) Bl. (*vide* p. 266), but the coarser and hairier leaf is a simple diagnostic character.

The epithet *ochrophloia*, given in manuscript by Mr. E. J. Strugnell, is descriptive of the yellow-brown colour characteristic of the bole of this tree.

Collections examined:—

MALAY PENINSULA:

KEDAH: C.F. 27482 (TYPE of flower of *S. ochrophloia* E.J.S.).

KELANTAN: C.F. 33356.

PERAK: C.F. 25634, 27250, 29016 (TYPE of fruit of *S. ochrophloia* E.J.S.) 29017, 29020, 30735, & 30923.

TRENGGANU: C.F. 26882.

PAHANG: C.F. 10628, 26032, 26048, 26219, 27884, & 29962.

SELANGOR: C.F. 22964 & s.n. (Mitchell, 1st. Aug., 1918).

NEGRI SEMBILAN: C.F. 12838, 20851, & 32690.

Shorea ochrophloia is a little-known species that is here described for the first time. It appears in our list of Botanical Equivalents under the vernacular name of *seraya batu*. The tree appears to have a wide distribution on low hills throughout the Peninsula but it is not known to be common anywhere. The timber is placed by Mr. Desch (Mal. Forester 4: 28) in the *damar laut merah* grade.

Shorea collina Ridl. in Agri. Bull. S.S. & F.M.S. 9: 182 (1910), et Fl. Mal. Penins. 1: 231 (1922); Burn-Murdoch, Trees and Timbers Mal. Penins. 1: 13, tab. (1911); Heyne, Nutt. Pl. Ned. Ind. 3: 299 (1917), 2nd edit. 3: 1116 (1926); Foxw., Mal. For. Rec. 3: 63 (1927) partim, et Mal. For. Rec. 10: 173 (1932) partim; non Sym. apud Desch in Mal. Forester 3: 195 (1934): *Shorea angustiloba* Foxw., Mal. For. Rec. 10: 168, tab. XI (1932); Sym. in l.c. (1934), et l.c. 4: 26 (1935). Plate XVIII.

Branchlets flattened when young, dark purple to black, usually with a few minute stellate hairs; later terete, black. *Leaves* broadly elliptic or ovate to elliptic-oblong, shortly blunt-acuminate at the apex, rounded to subcordate (sometimes subequal) at the base, usually about 7.0 cm. × 13.0 cm. but varying between wide limits, glabrous (except for the midrib) and usually drying dull grey above, glabrous and usually red- or purple-brown beneath; midrib slightly sunk and fugaceous-tomentose above, strongly elevate striate glabrescent beneath; main nerves about 12 pairs, strongly elevate on the lower surface, inconspicuous above; nervules joining the main nerves in fine parallel lines, with fine reticulations between them, distinct beneath, less conspicuous above; petioles thick, rugose, slightly swollen in



Shorea collina Ridl.

the upper portion, 2.0–3.0 cm. long, black, glabrescent; stipules caducous (not seen). *Panicles* axillary and terminal, main branches thin, 2.0–4.0 cm. long, puberulous, black; lateral branchlets less than 1.0 cm. long, puberulous, each bearing 1 to 3 flowers. *Flowers* about 2.0–3.0 cm. apart, about 8.0 mm. long (including the pedicel); pedicel about 1.0 mm. long, rugose, tomentose. *Sepals* rotundate, apiculate, two slightly smaller than the other three, tomentose outside, glabrous inside. *Petals* oblong to linear-oblong, broader at the base, pubescent outside, glabrous inside. *Stamens* 55 (one flower only examined), of several sizes—the inner row twice as high as the outer; anthers oblong, posterior cells smaller than the anterior; filaments one to four times as long as the anthers, broad and subgibbous below (particularly the inner row), suddenly narrowing to the filamentous upper portion; appendage to connective about one half the length of the anther, slightly reflexed, with 2 to 5 bristles. *Ovary* ovate, densely setose; style short, cylindric, glabrous; stigma minute, slightly 3-notched. *Fruit*—a nut with 5 rudimentary wings; stalk 3.0–5.0 mm. long, stellate-puberulous; bases of calyx lobes thickened, woody, pale fagaceous-tomentose, red-brown beneath, enclosing half of the nut; three large outer wings irregular in size, linear-oblong, up to 4.0 cm. $\times$ 1.0 cm. but usually smaller, puberulous, red-brown, about 7-nerved; two inner wings linear, 1.5 cm. or less $\times$ 3.0–4.0 mm., about 4-nerved; nut ovate-orbicular, rostellate, 2.5–4.0 cm. $\times$ 2.0–3.0 cm., pale tomentose; rostellum up to 7.0 mm. long.

Shorea collina was first described by Ridley from a fragmentary flowering specimen (319) collected in 1910 by A. E. Sanger-Davies in Rompin, Pahang, under the vernacular name of *balau bukit*. In 1927 and 1932 Foxworthy added notes under the heading of *S. collina*, but the additional collections, upon which his information was based, belonged to a closely related, but different, species which I am naming *Shorea Foxworthyi*. This latter species has, for some years been considered to be *S. collina* by members of the Forest Department and has been wrongly so named by me in l.c. Collections of the real *S. collina*, made subsequent to 1910, were not recognised as such, but were redescribed under the name of *Shorea angustiloba* Foxw. in 1932. Critical study of the one complete flower remaining upon our type sheet of *S. collina*, and comparison with a recently acquired collection of flowers of the species confused with it, have enabled me to correct this error. Unfortunately the type sheet, which is the only known collection of flowers, is too fragmentary to give a very good idea of the inflorescence.

S. collina, which clearly belongs to the section *Eushorea*, is remarkable in the number of stamens, the shape of the filaments, and the large, short-winged nut. The flower structure is very similar to that of a species erroneously considered by Philippine botanists to be *Shorea balangeran* (Korth) Dyer *ex* Vidal (*vide* p. 273). These species (*S. collina* and *S. balangeran* Auct. non Dyer) are, however, readily distinguishable on vegetative and fruiting characters.

Collections examined:—

MALAY PENINSULA:

TRENGGANU: C.F. 26700, 26730, & 26909.

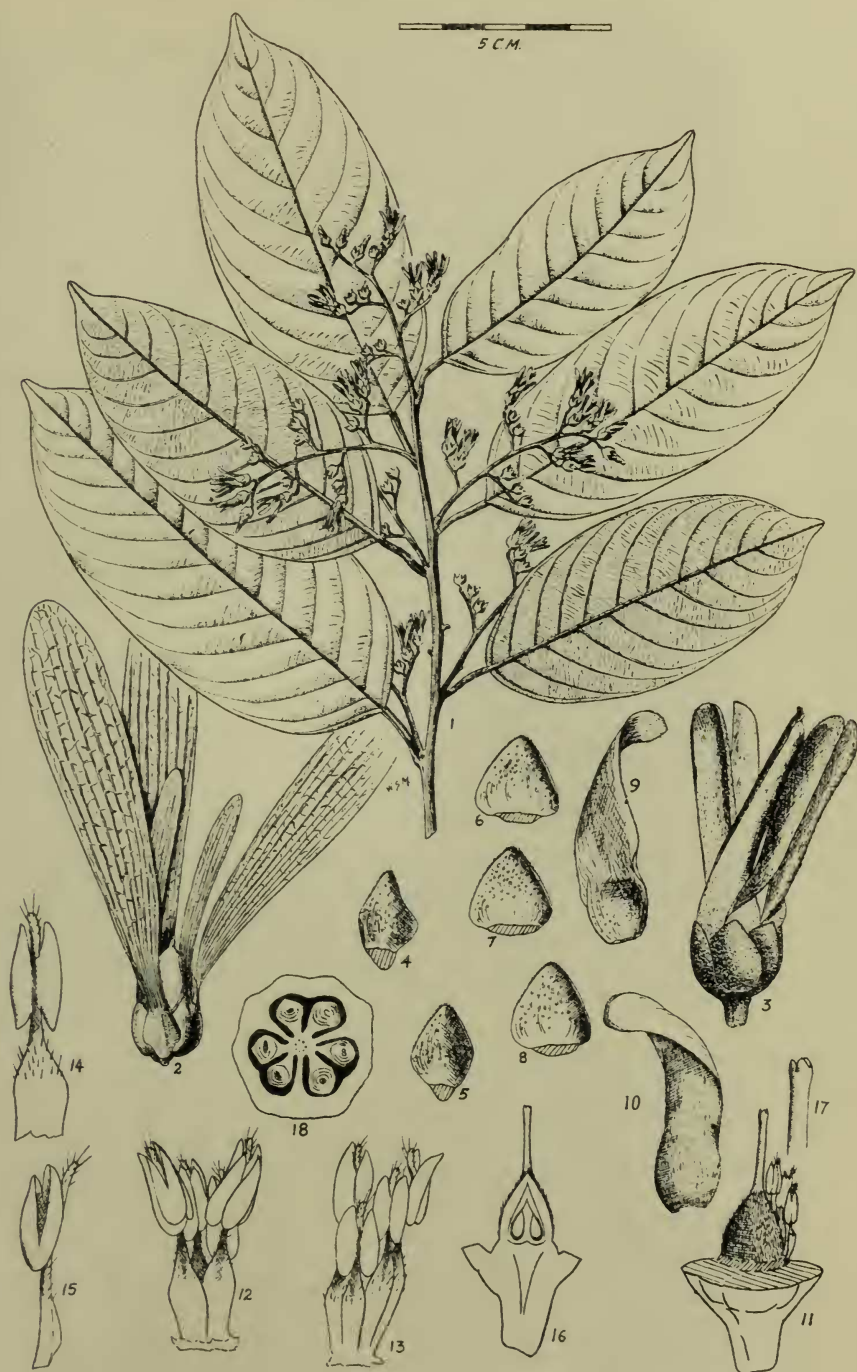
PAHANG: C.F. 319 (Type of *S. collina* Ridl.), 6672, 8103, 8117, 8171, 8184, 8186, 9509 (Type of *S. angustiloba* Foxw.), 17351, 27888, 27940, & 29336.

This is the tree known as *balau merah* in Pahang East. It was described as *Shorea angustiloba* in Mal. For. Rec. 10 owing to misinterpretation of the collection described by Ridley in 1910 as *Shorea collina*. *S. angustiloba* now lapses into synonymy and our *balau merah* becomes *Shorea collina* (*c.f.* notes on *Shorea Foxworthyi*, p. 274).

Shorea Foxworthyi Symington sp. nov. *Shorea collina* Foxw., Mal. For. Rec. 3: 63 (1927), et Mal. For. Rec. 10: 173 (1932) (excl. 319), non. Ridl. in Agri. Bull. S.S. & F.M.S. 9: 183 (1910); Sym., apud Desch in Mal. Forester 3: 195 (1934) non Ridl. Plate XIX.

Shorea collinae Ridl. affinis, sed filamentis ciliatis, ciliis appendiculorum numerosioribus, stylo longiore, nuce parviore, segmentis calycis fructiferi longioribus differt.

Branchlets slightly flattened when young, grooved, minutely dense fulvous tomentose; later glabrescent, black. *Leaves* elliptic, elliptic-oblong, ovate-lanceolate, or subovate, acuminate and blunt or mucronate at the apex, rounded to subcordate at the base, usually about 11.0 cm. $\times$ 5.0 cm., glabrous and normally drying chocolate-brown above, apparently glabrous (except on the midrib and main nerves) but actually minutely lepidote and yellow-brown or red-brown beneath; midrib slightly sunk above, strongly elevate, striate, puberulous beneath; main nerves usually 11 to 14 pairs, strongly elevate on the lower surface, not raised and comparatively inconspicuous above; nervules joining the main nerves in numerous wavy lines, fine (but conspicuous) beneath, less conspicuous above; petioles grooved, thicker in the upper portion, of similar texture to the young branchlets; stipules oblong, subfalcate, rounded at the apex, 15.0 mm. $\times$ 3.0 mm., sericeous inside, coarsely fulvous



Shorea Foxworthyi Sym.

stellate-tomentose outside, caducous. *Panicles* axillary and terminal; main axis stout, grooved, up to 5.0 cm. long, fulvous tomentose; lateral branchlets 4.0 mm. apart, regularly alternating, less than 1.0 cm. long, tomentose, each bearing 1 to 3 secund flowers. *Flowers* about 3.0 mm. apart, ovate-lanceolate in bud, about 1.0 cm. long (including the pedicel); pedicel about 1.0 mm. long, grey tomentose. *Sepals* ovate, obtuse, two slightly smaller than the other three, grey tomentose outside, glabrous inside. *Petals* linear-oblong, slightly contorted in bud, pubescent outside, glabrescent inside, yellow (M. L. Webber, C.F. 30301). *Stamens* 33 to 41 (in flowers examined), arrangement somewhat obscure; anthers oblong, posterior cells smaller than the anterior; filaments as long as to twice the length of the anthers, broad at the base, slightly broader and setose about the middle, narrow at the apex; appendage to connective oblong, about half as long as the anthers, with 7 to 12 unequal bristles. *Ovary* hemispherical, narrowed above, densely setose; style as long as the ovary, cylindric, glabrous, stigma slightly enlarged, obscurely 3-notched. *Fruit*—a 5-winged nut: stalk about 1.0 mm. long, sparsely stellate-hairy; bases of the calyx lobes thickened and woody, enclosing less than half of the nut, sparsely stellate-hairy; three outer wings large, oblong-spathulate, narrowed at the base, 9.0–14.0 cm. $\times$ 2.0–3.0 cm., glabrescent, shining red-brown, 9 to 11-nerved; two inner wings smaller, linear, usually about 5.0 cm. $\times$ 0.6 cm. but very variable, about 3 to 6-nerved; nut ovoid, rostellate, about 2.2 cm. $\times$ 1.7 cm., pale tomentose; rostellum up to 4.0 mm. long.

The first collection of this species (C.F. 9507) was made by F. W. Foxworthy in Baloh Reserve, Kuantan, in 1923. This, along with subsequent collections of the species, was identified by him with Ridley's *Shorea collina*, and in 1932 he described the fruits of 9507 as the fruits of *S. collina*. This error has been repeated in Mal. Forester 3: 193 and other Forest Department publications.

I am now renaming the species *Shorea Foxworthyi*. It is very closely related to *S. collina* Ridl., but the flowers differ in the ciliate filaments, the more numerous cilia on the appendages, and the longer style. The fruits, of course, although essentially similar, differ very markedly in size and in the nature of the calyx wings.

From the Philippines I have seen three sheets (For. Bur. No. 27099, 27381*, & 31057) that are remarkably similar to *S. Foxworthyi* in vegetative characters. Floral

* 27099 & 27381 are cited in Merr. Enum. Philip. Pl. 3: 96 (1923) as *Shorea balangeran* (Korth.) Dyer ex Vidal, but it is very evident that they are not that species.

dissection of 27099, however, shows that the species is quite distinct, although clearly a member of the same group.

Collections examined:—

MALAY PENINSULA:

PERAK: C.F. 4570, 5386, 8839, 14376, 24492, 24613, 24614, 24616, 24631, 24637, 24646, 24822, 25416, 28063, 28804 (Type of fruit of *S. Foxworthyi* Sym.), 29041, 29704, 30301 (Type of flower of *S. Foxworthyi* Sym.) 30677, 30814, 30895, 31041, 31044, 31084, 32176, 33901, 33902, 33903, 33904, 33905, 33906, & 41560.

TRENGGANU: C.F. 26685, 26712, 26731, 26736, & 26911.

PAHANG: C.F. 1683, 6828, 9507 (Type of fruit of *S. collina* Foxw. non Ridl.), 14902, 17221, 17222, 28801, & 29664.

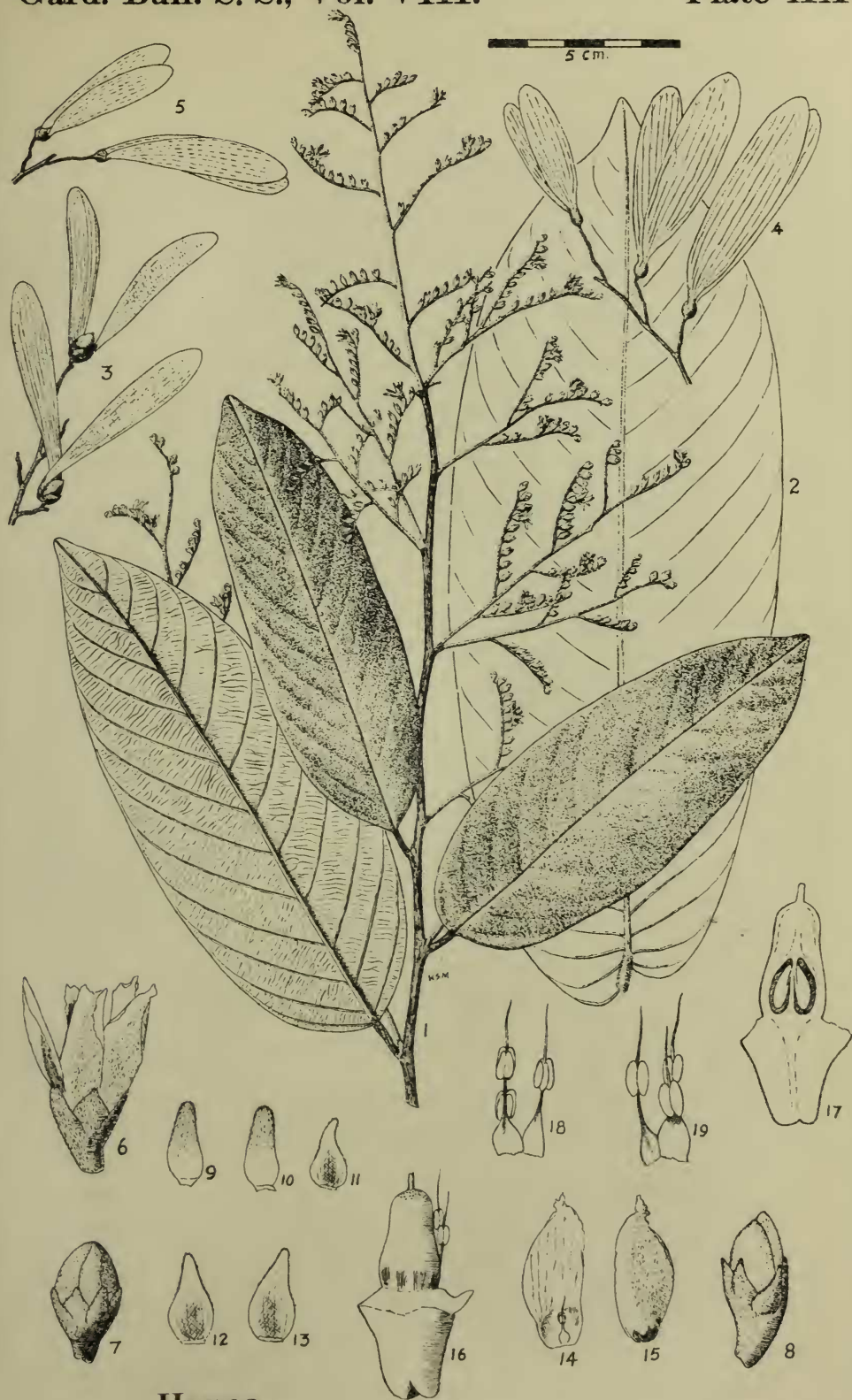
JOHORE: C.F. 12059.

This is the species for which the preferred name in the Federated Malay States is *balau bukit*. For some years it has been known to Malayan forest officers as *Shorea collina*. It is here shown that this is an error/resulting from the misapplication of the name *Shorea collina*, which rightly belongs to our *balau merah*—a species redescribed in *Mal. For. Rec.* 10 as *Shorea angustiloba*.

Hopea Helfer (Dyer) Brandis in Journ. Linn. Soc. 31: 62 (1895) tab. 2, 1 & 2, et Ind. Trees 67 (1911); Fischer in Kew Bull. 1927: 206; Sym. in Gdns. Bull. S.S. 8: 22 (1934), in obs.: *Vatica Helfer* Dyer in Hook. f. Fl. Brit. Ind. 1: 302 (1874); *Shorea Helfer* Kurz, For. Fl. Brit. Burma 1: 119 (1877); *Hopea dealbata* Hance in (London) Journ. Bot. 15: 329 (1877); Lanessan, Pl. Utiles, Col. Franc. 300 (1886); Pierre, Fl. For. Cochinch. fasc. 16, tab. 246 (1890); Heim, Recherch. Diptérocyt. 61 (1892), in obs.; Brandis in Journ. Linn. Soc. 31: 62 (1895); Guérin ex Lecomte, Fl. Gén. Indo-Chine 1: 374 (1910) icon. 36; Lecomte, Bois l'Indo-Chine 110 (1926) tab. 32; Foxw., Mal. For. Rec. 10: 128 (1932). Plate XX.

Published botanical descriptions and figures of this species, being based on inadequate material, are not very satisfactory. I have therefore prepared the following:—

Branchlets dark purple-black, pale fugaceous-tomentose towards the ends. *Leaves* oblong or elliptic-oblong, apex blunt, acute, or subacuminate (but frequently damaged), base equal to markedly unequal and cuneate to cordate, usually about 16.0 cm. $\times$ 6.0 cm. but varying between wide



Hopea

~~*Shorea*~~ *Helferi* (Dyer) Brandis

limits, coriaceous, yellow- or light red-brown, glabrous above, pale yellow or silvery (densely minutely lepidote) beneath; midrib slightly depressed above, strongly elevate striate fugaceous-tomentose beneath; main nerves about 13 to 17 pairs, usually inconspicuous above, elevate beneath; nervules joining the main nerves in numerous, more or less parallel, lines, conspicuous only on the lower surface; reticulations minute; petioles 0.5–1.3 cm., thick, rugose, channeled above, black, glabrous when old; stipules linear, caducous (seen only on immature specimens). *Panicles* axillary and terminal, racemose, when mature about as long as the leaves, pale tomentose; ultimate branchlets about 7.0 mm. apart, 1.0–3.0 cm. long, each bearing 4 to 12 second flowers; bractioles small, caducous. *Flowers* about 2.0 mm. apart, subovate in bud, about 5.0 mm. long (including the pedicel); pedicel about 1.0 mm. long, sericeous tomentose. *Sepals* imbricate; two oblong-obtuse, thick, tomentose (except on the posterior basal portion); three ovate-acute or acuminate, thinner, tomentose outside only. *Petals* contorted in bud, elliptic-oblong, fimbriate at the apex, tomentose outside on the portion exposed in bud, pale yellow (Parkinson, 5199). *Stamens* 15, three appressed to each petal; anthers ovate-oblong, posterior cells slightly smaller than the anterior; filaments 1 to 2 times as long as anthers, broad and overlapping at the base, filamentous above; appendage to connective filiform, about one and a half times as long as the anther. *Ovary* broadly cylindrical-truncate, constricted in the middle, glabrous, the upper (stylopodial) portion sometimes subpapillose; style about one quarter the length of the ovary, cylindrical; stigma minute. *Fruit*: stalk 1.5 mm. long, pale tomentose; calyx lobes appressed at the base to the lower third of the nutlet; two large lobes linear-spathulate blunt, about 5.5 cm. $\times$ 1.0 cm. to 8.0 cm. $\times$ 2.0 cm., shining light brown, puberulous at the base, about 9-nerved; three small lobes ovate-acute, about 4.0 mm. $\times$ 3.0 mm., puberulous outside, less than one half the length of mature nut; nut ovate, apiculate, about 8.0 mm. $\times$ 6.0 mm., striate, glabrous, shining. *Embryo* as in *Hopea sangal* Korth.*

This species was first described by Dyer in 1874, from a collection (No. 716) made by Helfer at Mergui in Tenasserim. The type collection, of which I have seen the

* The normal embryo of *H. Helferi* is almost indistinguishable from that of *H. sangal*, but I have not noted any instance of multiple ovule development—a common feature of *H. sangal*. I might note here that, just before germination, the nutlets of this group become slightly inæquilateral, owing to the irregularly exerted pressure of the swelling embryo which finally ruptures the pericarp in an indeterminate fashion. This is a very different mode of germination from that of the *Pierrea* group (*vide Gdns. Bull. S.S. 8: 32*).

Kew and Calcutta sheets, bears flowers and has leaves with cordate, unequal bases. The systematic position of the plant seems to have puzzled several authors. Dyer originally referred it to *Vatica* in 1874, Kurz removed it to *Shorea* in 1877, while Brandis placed it in its present genus, *Hopea*, in 1895.

In 1877, Hance described a fruiting collection, of what he thought to be a new species from Cambodia, as *Hopea dealbata*. He cited no specimen, but Pierre, enlarging upon Lanessan's description in 1890, cited No. 1457, a sheet of which is at Kew. Although this sheet bears fruits only, and has truncate to subcuneate leaves, I am uniting it with *Hopea Helferi** without hesitation. A number of collections of the species, mainly from Burma and the Malay Peninsula, has accumulated of recent years. Some of these are an excellent match for *H. Helferi* and some for *H. dealbata*, while others are representative of gradations between the two. In examining this herbarium material one cannot but be impressed by the superiority of leaf texture over leaf shape as a diagnostic character.

Pierre, Heim, Brandis, and Foxworthy all refer the species to the *Euhopea* section of the genus. With this, as stated in *op. cit.* (1934), I am in entire agreement.

Collections examined:—

BURMA: Helfer 716 (Auth. Spec. of *Vatica Helferi* Dyer); Maymyo Nos. 7605 (Field No. 1929), 8329 (Field No. 5199), & 12198 (Field No. 11049).

CAMBODIA: Pierre 1457 (Auth. Spec. of *Hopea dealbata* Hance).

SIAM: Foxworthy 11; S'pore 24235.

MALAY PENINSULA:

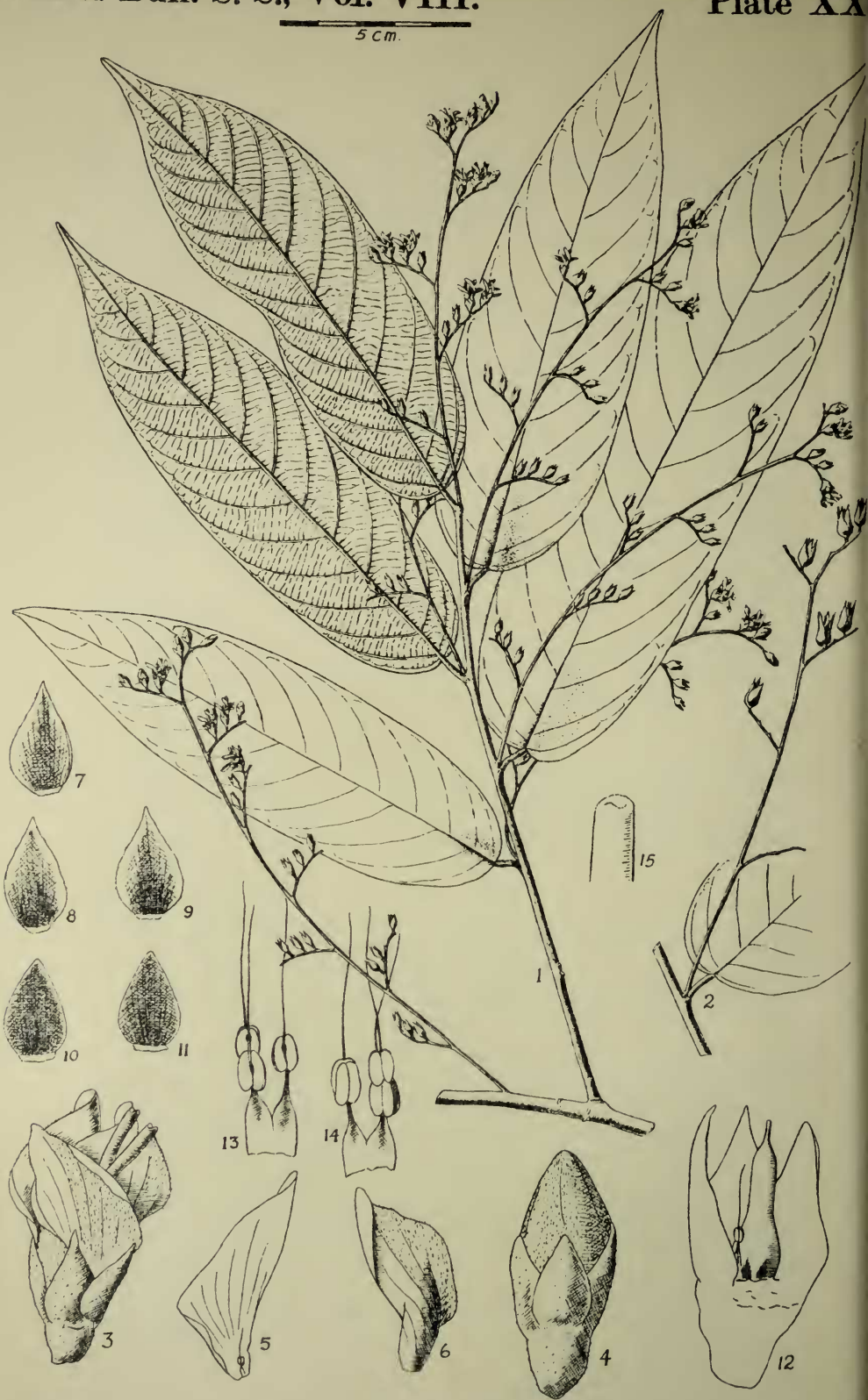
LANGKAWI: C.F. 7558, 7559, 7678, 7697, 8962, 12401, 20763, 20768, 21046, & 21462.

PERAK: C.F. 7048, 10406, 10413, 10235, 10417, 29043, 30806, 30917, & 30919.

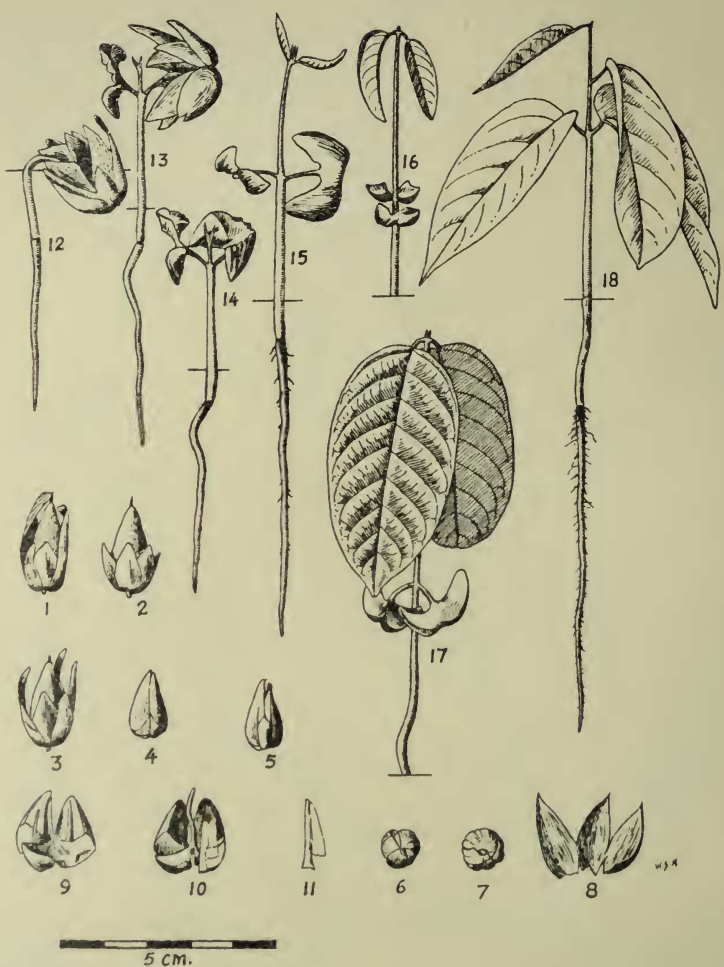
Hopea Helferi is the tree known as *lintah bukit* on the island of Langkawi. It is probably better known in Burma, Cambodia, and Siam than it is with us, having been found in the Peninsula only as far south as Lenggong in Upper Perak. The botanical name *Hopea dealbata* Hance (the Cambodian name) has been given to the tree in Mal. For. Rec. 10, but the species is shown to be conspecific with the species described earlier from Burma, and the older epithet is chosen in accordance with the rules of botanical nomenclature.

* The union was first proposed by me in *Gdns. Bull. S.S.* 8: 22 (1934).

5 cm.



Hopea apiculata Sym.



Hopea apiculata Sym.

Hopea apiculata Symington, **sp. nov.** Plates XXI & XXII

Species *H. laxae* Sym., *H. resinosa* Sym., *H. pachycarpae* (Heim) Sym., etc. affinis, nuce parvo, glabro, apiculato, segmentis brevibus chartaceis instructo, differt.

Branchlets dark purple but usually covered with a pale tomentum, with decurrent elevate lines from the insertion of the petiole. *Leaves* lanceolate or oblong-lanceolate, gradually tapering to the acuminate apex, base subequal, rounded, or subcordate, about 13.0 cm. $\times$ 3.5 cm. to 21.0 cm. $\times$ 6.0 cm., glabrous on both surfaces (except midrib and main nerves above), pale yellow-brown (sometimes with a green tinge) above, stramineous (or glaucescent) beneath (v.s.); midrib slightly depressed and tomentose above, strongly elevate beneath; main nerves 11 to 14 pairs, at an angle of about 45° to the midrib, inconspicuous but tomentose above, elevate beneath; nervules joining the main nerves in fine more or less parallel lines, almost invisible above, distinct beneath; petioles 7.0–10.0 mm. long, terete, rugulose, tomentose; stipules caducous (not seen). *Panicles* axillary (sometimes in axils of recently fallen leaves) or terminal, usually solitary (rarely 2), 4.0–20.0 cm. long (usually a little shorter than the leaves), lax, stramineous, glabrous; branchlets about 1.5 cm. apart, each bearing 2 to 5 (usually 4) secund flowers. *Flowers* about 4.0 mm. apart, ovate in bud, about 8.0 mm. long (including the pedicel); pedicel 1.0 mm. long, minutely lentiginose. *Sepals* minutely subciliate along the apical margins, otherwise glabrous; two outer ovate-acute; three inner slightly larger, ovate-acuminate, hyaline at the edges. *Petals* oblong-oblique, tomentose on the portion exposed in bud "yellowish when fresh" (Wilkinson). *Stamens* 15, pairs alternating with single stamens; anthers oval, posterior cells slightly smaller than the anterior; filaments 1 to 3 times as long as the anthers, broad and flattened below, gradually narrowing to the filamentous upper portion; appendage to connective filiform, slightly longer than the filament and anther. *Ovary* with stylopodium shaped somewhat like an hour glass, glabrous; style short, glabrous; stigma minute, apparently simple. *Fruit*: stalk 1.0 mm. long or less, puberulous; calyx lobes chartaceous above, woody in the lower portion, shortly united at the base to form a woody receptacle, all glabrous; three inner lobes ovate-acute (sometimes obtuse or acuminate), about 11.0 mm. $\times$ 6.0 mm.; two outer lobes ovate-oblong to linear-oblong, obtuse at the apex, tending to curve inwards, usually unequal in size, 1 to 2 times as long as the inner lobes but rarely longer than the nut; nut ovate-conical, about 1.7 cm. $\times$ 1.0 cm.,

sparsely puberulous to glabrous, surmounted by a prominent apicula about 2.0 mm. long. *Embryo* essentially as in *Hopea pachycarpa* (Heim) Sym.

This extremely interesting species, which was collected for the first time in 1935, is the second member of the *Pierrea* group of *Hopea** from the Peninsula. The fruits are peculiar—they are intermediate between the “*Balanocarpus*” (wingless) type and the “*Hopea*” type with two long wings. Another peculiarity is the entire absence of the resinous exudation commonly found cementing together the base of the nut and the bases of the sepals of species in the group.

Collections examined:—

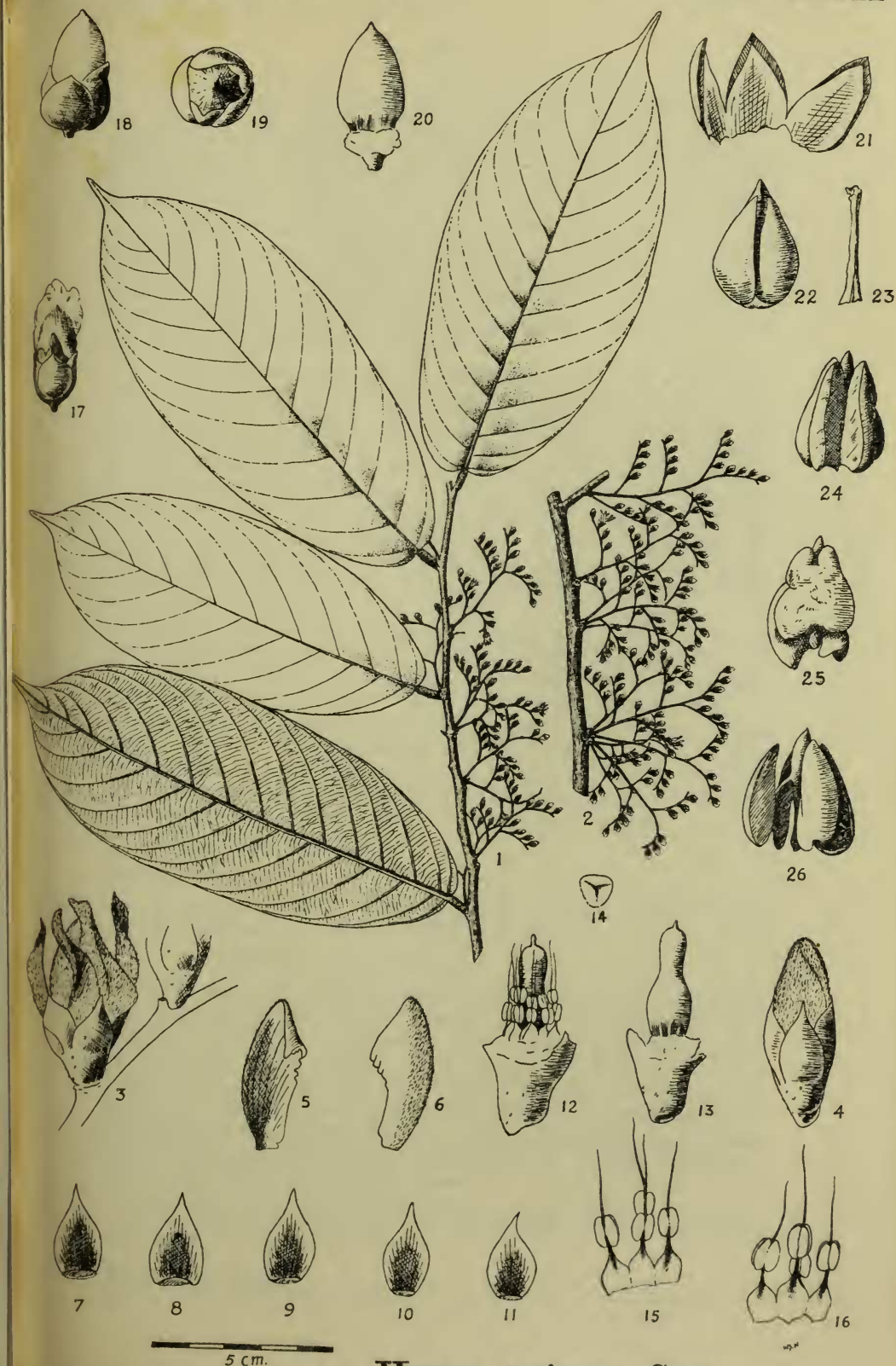
MALAY PENINSULA:

PERAK: C.F. 30322 (Type of flower of *H. apiculata* Sym.); G. Wilkinson; Compt. 8, Kenas Circle, Bubu Reserve, flat land; 29th Jan. 1935; flower. Field Note by Mr. Wilkinson—“Tree, height 50–75 feet; first branch 35–45 feet; diam. breast high 9–12 in., crown dense, spherical; bark white and black, smooth (one tree was fissured—fissures from small 2 in. cracks to 12 in. deep vertical gashes); buttresses absent to 3 feet in height; bark $\frac{1}{4}$ in. and over; stem not usually absolutely straight, tapers to 8” diam. at first branch; branches many and much forked, leave the stem pointing slightly upwards but are pendulous after half their length; regeneration very dense, leaves of seedlings larger than those of mature tree.” C.F. 16828, 39104, 39105, & 39106 (Type of fruit of *H. apiculata* Sym.).

Hopea apiculata is a “new” species recently discovered by Mr. Wilkinson in Bubu, and Mr. Carcenac in Bruas, Forest Reserves. Both officers report that the tree regenerates prolifically but that it does not attain large dimensions. The timber appears to approach “balau” in quality and the species may be useful as a pole crop. The leaves are very similar to those of *chengal* (*Balanocarpus Heimii*) and Mr. Carcenac reports that these species are commonly confused in young stages. The only vernacular name so far reported for *H. apiculata* is *resak*, but this is hardly appropriate and should not be encouraged.

***Hopea resinosa* Symington, nom. nov.: *Balanocarpus pubescens* Ridl., Fl. Mal. Penins. 1: 247 (1922); Foxw., Mal. For. Rec. 10: 147 (1932); Sym. in Gdns. Bull. S.S. 8: 28 & 32 (1934), in obs. Plate XXIII.**

* Vide *Gdns. Bull.* S.S. 8: 27 & 32 (1934).



Hopea resinosa Sym.

This species was first collected in the Kuantan district of Pahang by Forest Ranger Yeop, in 1919. Ridley examined this collection (of fruit only) and described it as *Balanocarpus pubescens* in 1922. Foxworthy, with additional material, gave a more complete description in 1932.

I have already discussed the systematic position of this plant in *loc. cit.* I have stated that the species is a typical member of the *Pierrea* group of *Hopea* and is very close indeed to *Hopea pachycarpa* (Heim) Sym. In making the transfer to *Hopea* a new specific name must be given, *Hopea pubescens* being already occupied.

Foxworthy's description, together with the plate published with this paper, should provide adequate definition of the species. I might add some remarks concerning the species with which *H. resinosa* is most liable to be confused in the herbarium, i.e. *H. pachycarpa* and *H. philippinensis*. In all essential characters *H. resinosa* is almost identical with the former, but may be distinguished without difficulty by the *facies* of the dried specimen. In *H. pachycarpa* the leaves are more coriaceous and more glabrous, have somewhat thicker petioles and less distinct reticulations, and dry chocolate-brown above as opposed to pale green in *H. resinosa*. The dried sterile specimen of *H. resinosa* has a *facies* very like that of *H. philippinensis*, but may be distinguished by the less inæquilateral leaf and the absence of domatia in the nerve axils. Fruiting material is, of course, quite distinct, *H. philippinensis* having two long wings and *H. resinosa* none. Flowering material, on the other hand, is very similar in both species but in *H. resinosa* the sepals are subequal in flower, while in *H. philippinensis* two sepals are clearly differentiated even in bud.

Collections examined:—

MALAY PENINSULA:

PAHANG: C.F. 3602 *a* & *b* (Auth. spec. of *B. pubescens* Ridl.), 15687, & 29671.

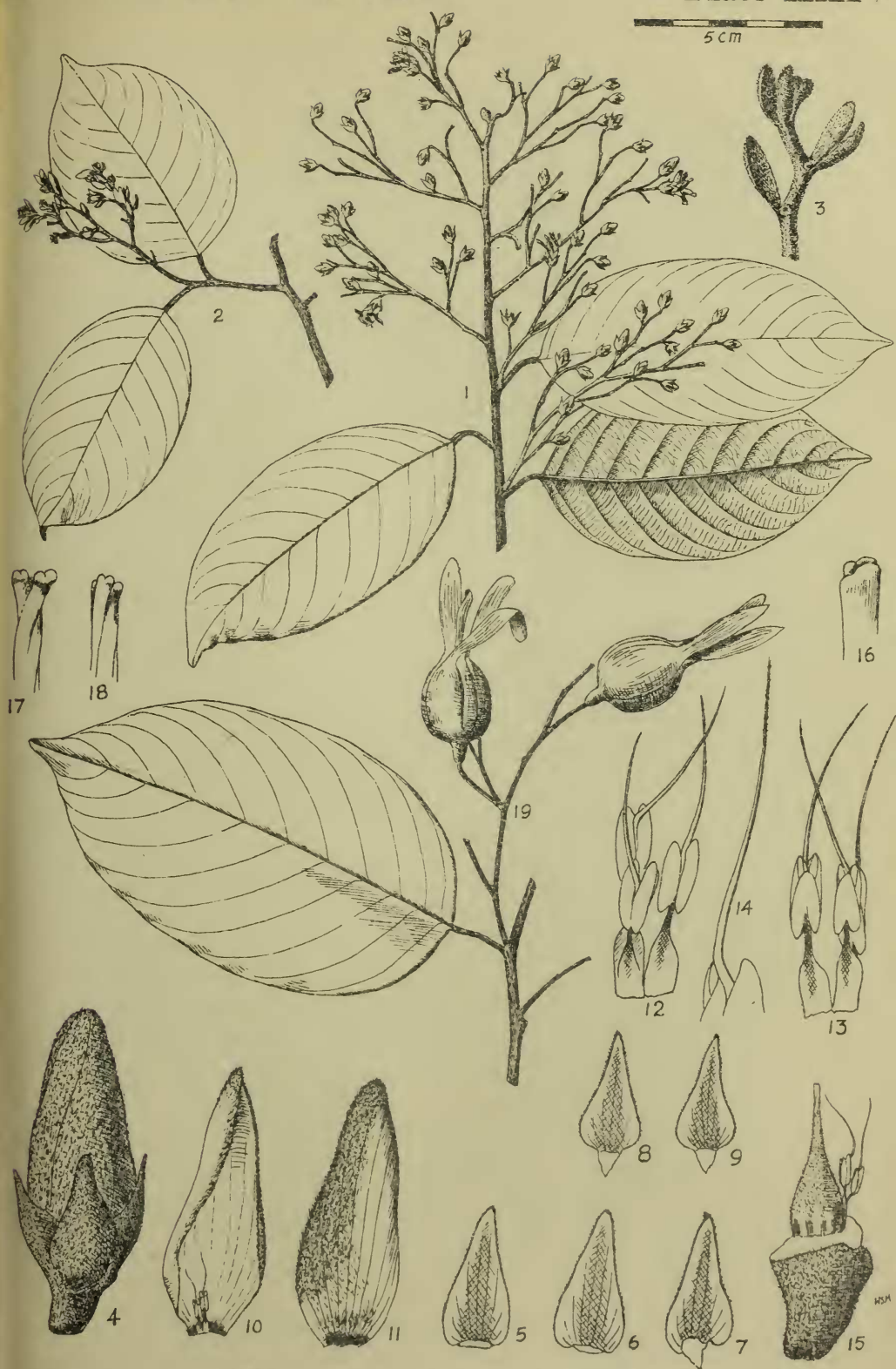
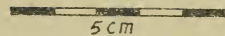
JOHORE: S'pore 28514.

A small dipterocarp with smooth bark and stiltroots has been collected several times, from the Kuantan and Rompin districts of Pahang, under the vernacular names of *merawan mata kucing* and *boyan* (said to be a Sakai name). In 1922 it was described as *Balanocarpus pubescens* but it is shown that the species is more correctly referable to the genus *Hopea*. The transfer is here made and a new specific name "*resinosa*"* is chosen because a *Hopea pubescens* already exists.

* This name is descriptive of the peculiar resinous coating on the fruits.

Shorea bentongensis Foxw., Mal. For. Rec. 10: 169 (1932) tab. XII: *Shorea pahangensis* Foxw., op. cit. 193, tab. XV, non Ridl. Ms. in Herb. Kew (= *S. bractiolata* Dyer). Plate XXIV.

Branchlets dark with a red tinge, tawny to ferruginous tomentose towards the ends. *Leaves* oval or ovate to elliptical, acuminate at the apex (acumen sometimes exceeding 1.0 cm. long), rounded at the base, from about 8.0 cm $\times$ 3.7 cm. to 16.0 cm. $\times$ 8.5 cm., glabrous except on the midrib above, minutely lepidote and sparsely stellate-hairy on the nerves beneath, drying light brown or yellow-green on both surfaces; midrib depressed and tomentose above, strongly elevate striate puberulous beneath; main nerves 11 to 16 pairs, inconspicuous above, prominent and puberulous beneath; nervules joining the main nerves in numerous more or less parallel lines, obscure above, prominent on the lower surface; petioles 0.8–1.3 cm., rugulose, channeled, dark, tomentose when young, later puberulous; stipules caducous, ovate to linear-oblong, subfalcate, 8.0 mm. $\times$ 4.0 mm. to 10.0 mm. $\times$ 3.0 mm., 3 to 5-nerved, pubescent (sapling specimens only seen); buds small, flattened, ferruginous tomentose. *Panicles* mainly axillary towards the ends of the branchlets, subtended by leaves or caducous bracts, usually solitary, up to 8.0 cm. long, striate, tomentose when young, later pale puberulous; main axis of panicle alternately branched; branchlets at irregular intervals, solitary or in pairs, simple or bifurcate, usually 2 to 3-flowered, subtended by caducous bracteoles. *Flowers* each subtended by a caducous bracteole or paired bracteoles, ovate in bud, about 8.0 mm. long (including the pedicel); pedicel 1.0–2.0 mm. long, pale tomentose. *Sepals* pale tomentose outside and, on the upper portion, inside; three outer ovate-oblong, obtuse or acute; two inner ovate-acuminate, thin at the edges. *Petals* ovate-oblong, pale tomentose outside (except for a narrow portion along one edge), pale yellow. *Stamens* normally 15 (15 to 20, Foxworthy), pairs alternating with single stamens; anthers oblong or ovate-oblong, posterior cells slightly smaller than the anterior; filaments 1 to 2 times as long as the anthers, broad and flattened below, narrowing gradually to the filamentous upper portion; appendage to connective 2 to 3 times as long as the anther, filiform, minutely setose in upper third (only visible under high magnifications). *Ovary* ovate-conical, tapering gradually into the style, minutely tomentose; style as long as the ovary, the upper half glabrous; stigma minute, obscurely (usually 3-) lobed. *Fruit* (immature specimens only seen)—a nut with 5 rudimentary wings; stalk thick, about 4.0 mm. long, with a



Shorea bentongensis Foxw.



Shorea inaequilateralis Sym.

few stellate hairs; bases of calyx lobes forming an ovate-orbicular covering around the nut, woody, glabrescent or sparsely puberulous; three wings linear, acute or obtuse, up to 3.5 cm. $\times$ 1.0 cm., about 7-nerved, puberulous when young (material inadequate for further description).

Shorea bentongensis was first collected in the Bentong district of Pahang in 1919 and described by Foxworthy in 1932. At that time the only flowering specimens available were C.F. 5875 (cited by Foxworthy under *S. globifera*) and C.F. 15774 upon which Foxworthy based his *Shorea pahangensis*. This latter specimen bears immature inflorescences and does indeed, at first glance, appear very different from the type of *S. bentongensis*. Careful study, however, with the added assistance of a recent excellent flowering collection of the species, makes it quite clear that *S. bentongensis* Foxw. and *S. pahangensis* Foxw. are conspecific.

The systematic position of this species presents no difficulties—it is a typical member of the section *Anthoshorea*.

Collections examined:—

MALAY PENINSULA:

PAHANG: C.F. 3937, 15632, 15774 (Type of *S. pahangensis* Foxw.), 17275, 26215, 26505 (Type of *S. bentongensis* Foxw.), & 28052.

SELANGOR: C.F. 27898 & 29801.

JOHORE: C.F. 5875.

Shorea bentongensis is known to forest officers in Pahang West as *meranti mengkai*. It is shown that a specimen described in Mal. For. Rec. 10 as *Shorea pahangensis* is not specifically distinct and the two species are united, the name *Shorea bentongensis* being preserved.

Shorea inaequilateralis Symington, **sp. nov.**: “*semayor*”, Durant, Rep. For. Brunei pp. 37 & 42 (1933). Plate XXV.

Species floribus *S. palembanicae* Miq. affinis, sed foliis inaequilateralibus breve-petiolatis, stipulis bracteisque panicularum persistentibus, nuce longe-alato rostellato differt.

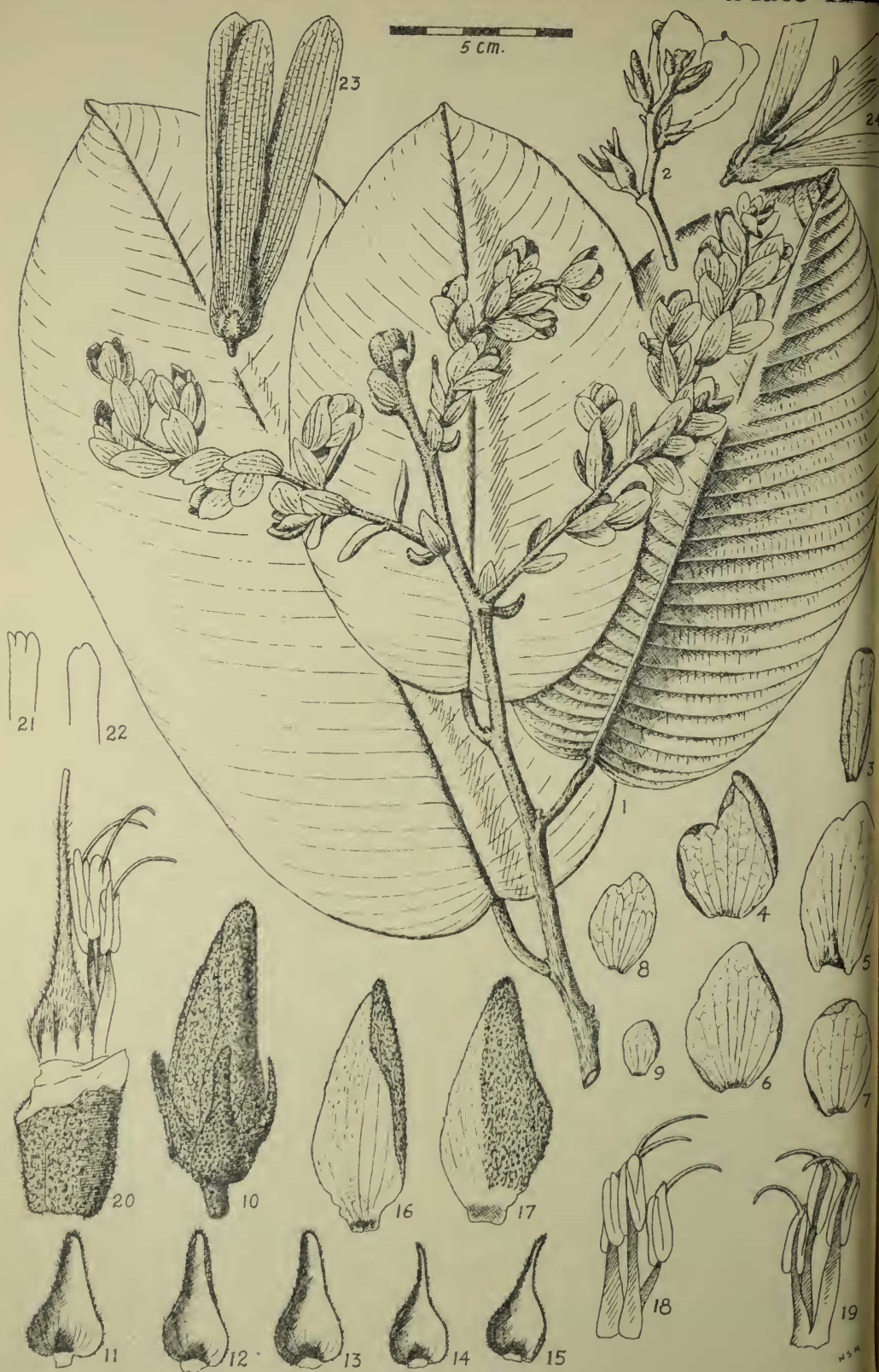
Branchlets ridged, tawny tomentose (dark purple-red underneath the tomentum). *Leaves* inaequilateral, oval to elliptic-oblong, long-acuminate at the apex (acumen up to 2.0 cm. long), cordate at the base, or rounded on one side, and cordate on the other, about 8.0 cm. $\times$ 3.5 cm. to 14.0 cm. $\times$ 6.0 cm., sparsely stellate-hairy (except midrib) above, sparsely stellate-hairy to densely silvery tomentose

beneath, drying usually to a dull purple-red above, stramineous to silvery beneath; midrib slightly depressed and densely tomentose above, elevate stellate-tomentose or sparsely stellate-hairy and striate beneath; main nerves about 11 to 13 pairs, inconspicuous above, elevate and hairy or tomentose beneath; intermediary nerves occasionally present; nervules joining the main nerves in more or less parallel lines, inconspicuous above, more prominent beneath; petioles 0.7–1.0 cm. long, thick, rugose, tomentose; stipules oblong-lanceolate, subcymbiform, about 2.0 cm. long, puberulous, persistent towards the ends of the branchlets. *Panicles* axillary (or subaxillary) and terminal, solitary, when axillary about as long as the leaves, tawny tomentose at the base, hairy towards the ends, usually consisting of 2 to 4 regularly alternating branchlets and terminating in an apparently sympodial arrangement; peduncles about 2.0–4.0 cm. long, with two subopposite, cymbiform, bifid, persistent bracts about the middle; branchlets subtended by persistent stipular bracts about 1.0 cm. long, each bearing 2 to 3 secund flowers; bracteoles subtending the flowers caducous (not seen). *Flowers* about 0.8 cm. apart, ovate-lanceolate in bud, 1.5–2.0 cm. long (including the pedicel); pedicel 2.0 mm. long, pale tomentose. *Sepals* tomentose outside and hairy on the upper portions inside; three outer oblong-lanceolate, acute; two inner ovate-acuminate, slightly shorter. *Petals* linear-oblong, rounded at the apex, silvery tomentose outside (on the portion exposed in bud), "white striped with red" (native collector). *Stamens* 15, of two different lengths, pairs alternating with single stamens; filaments broad at the base, filamentous above, 1 to 2 times as long as the anthers; anthers oblong, posterior cells smaller than the anterior; appendage to connective filiform, slightly longer than the filament and anther, minutely setose towards the end (only visible under high magnifications). *Ovary* ovate-conical, tapering gradually into the style, villous (except for the glabrous basal portion); style cylindrical, about twice as long as the ovary, pilose on the lower half, glabrous above; stigma minute; apparently simple. *Fruit*—a 5-winged nut; stalk about 4.0 mm. long, sparsely hairy; bases of accrescent calyx lobes thickened and woody, embracing one half of the nut, sparsely hairy; three outer wings subequal, linear-spathulate, acute or rounded at the apex, narrowed at the base, about 11.0 cm. $\times$ 1.5 cm. to 14.0 cm. $\times$ 2.0 cm., 9 to 11-nerved with conspicuous transverse nervules, sparsely stellate-puberulous on both surfaces, red-brown when mature; two inner wings subequal, about two thirds as long as the outer wings, acute at the apex, about 0.4–1.0 cm. broad, about 8-nerved, texture as in large wings; nut ovate, rostellate, about 2.5

Branchlets coarse, flattened, lentiginose, densely cinereous stellate-tomentose when young; later becoming terete, glabrescent, dark or glaucescent. *Leaves* elliptical, elliptic-oblong, or elliptic-obovate, shortly (usually blunt) acuminate at the apex, rounded at the base, about 9.0 cm. $\times$ 4.0 cm. to 15.0 cm. $\times$ 7.0 cm., glabrous and usually drying to a dull light red-brown above, lentiginose and densely close stellate-tomentose (at first whitish but becoming darker) beneath; midrib depressed above, elevate and cinereous tomentose beneath; main nerves about 17 to 24 pairs, not elevate above (frequently inconspicuous), slightly elevate and more distinct beneath; 1 or sometimes 2 intermediary nerves (up to 1.5 cm. long) occur between the main nerves; nervules in numerous parallel lines joining the main nerves, invisible but indicated on the lower surface by rows of large stellate hairs; petioles 2.0–3.0 cm. long, rugose, cinereous stellate-tomentose; stipules caducous (not seen). *Panicles* axillary and terminal, solitary, usually shorter than the leaves; main branches flattened, texture as in young branchlets; ultimate branchlets about 4 to 10, about 1.0 cm. apart, regularly alternating, simple or bifurcate (sometimes from the base), about 1.0–3.0 cm. long, usually 3 to 4-flowered, silvery tomentose. *Flowers* secund, about 0.8 cm. apart, subsessile, about 1.0 cm. long in mature bud. *Sepals* densely silvery tomentose outside and along the upper margin inside; three outer ovate-oblong, obtuse; two inner ovate-acute or acuminate, slightly shorter. *Petals* linear-oblong, blunt minutely silvery tomentose outside with a dense hairy apical fringe, glabrous on the side covered in bud, yellow (native collector). *Stamens* 20 to 25, variable in length; filaments broad and flattened below, narrowing rather abruptly to the filamentous upper third; anthers oblong,* slightly broader at the base, usually longer than the filaments, posterior cells smaller than the anterior (similar to those of *Anisoptera laevis* Ridl.); appendage to connective—a short, curved awn (seen to be slightly papillose under high magnifications). *Ovary* ovate-conical, tapering gradually into the style, glabrous at the base, villous above; style cylindrical, about one and a half times as long as the ovary, villous below, glabrous and often elliptical in cross-section in the upper half; stigma not enlarged, simple or minutely bifid. *Fruit*—a 5-winged nut;† stalk 1.0–2.0 mm. long, stellate-hairy; bases of accrescent calyx lobes thickened and woody, embracing rather more than one half of the nut, stellate-hairy; three outer calyx lobes linear-spathulate, about 6.0 cm. $\times$ 1.0 cm. to 7.5 cm. $\times$ 1.3 cm.,

* The abnormal stamen found in one flower, and figured in Plate XXII No. 14, is of interest.

† The fruits described are possibly not quite mature.



Shorea ochracea Sym.

about 10-nerved, with conspicuous obliquely transverse nervules, puberulous and with a few large stellate hairs at the base, dull light brown when mature; two inner lobes linear, 2.0 cm. $\times$ 0.3 cm. to 4.0 cm. $\times$ 0.5 cm., of similar texture to the outer wings; nut globulose, rostellate, about 1.0 cm. long, pale tomentose; rostellum 2.0–3.0 mm. long, villous (frequently broken).

This species is most readily referable to the section *Anthoshorea* but is quite distinct from any member of that group that I have examined. Sterile material is readily recognizable on account of the characteristic pale stellate-lepidote tomentum on the under surfaces of the leaves and on the young twigs.

Collections examined:—

SARAWAK: For. Dept. Sar. 154 (TYPE of fruit of *S. albida* Sym.); B. J. C. Spurway; Bukit Lima F.R., Compt. 1, freshwater swamp; 3rd May 1932; fruit. Field notes—vern. name, "*meraka paya*", tall tree, 140 feet high, 9 feet 10 in. girth.

BRUNEI: For. Dept. Sar. 174. C.F. 30353 (TYPE of flower of *S. albida* Sym.); Zainal; Kuala Belait, swamp; 23rd March 1934; flower. Field notes—vern. name, "*seringawan*", tree 130 feet high, and 60 in. girth, flower yellow, plants blackish, bark used for making walls of houses.

C.F. 28680, 28699, 28700, 30565, & 30588.

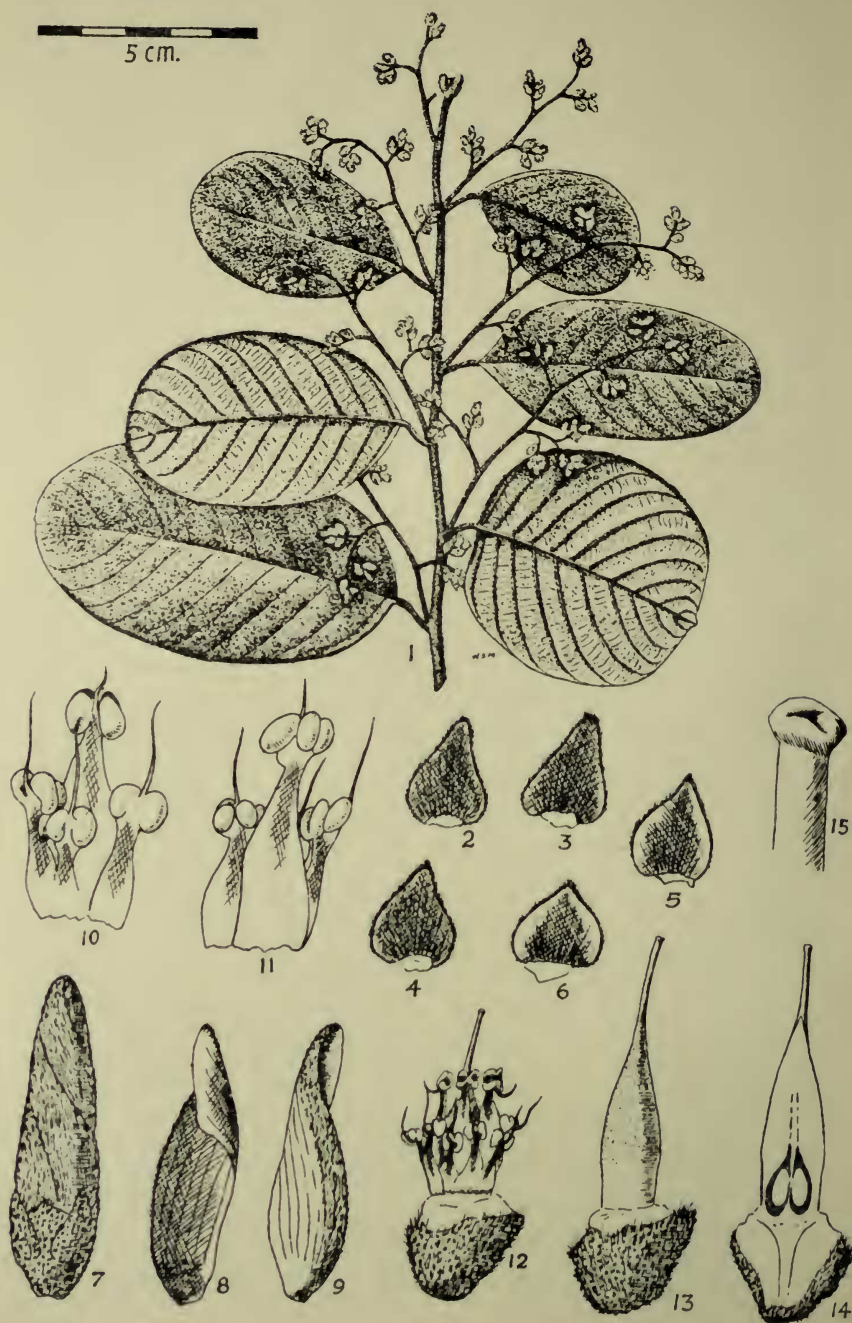
Specimens of a tree, called *seringawan* in Brunei, were first collected in Sarawak in May 1932 by Mr. Spurway. Subsequently Messrs. Durant and Smith have made several collections and drawn attention to the comparative abundance of the species in the coastal swamp forests of Brunei. With a view to the possible importance of the timber for export, pilot tests have been carried out in our laboratories at Sentul, the timber being favourably reported upon as a "good-grade red meranti". It is here described and named *Shorea albida*.

Shorea ochracea Symington, **sp. nov.**; non *S. ochracea* Dyer, Ms. in Herb. Kew (= *S. inappendiculata* Burck): "*majau*", Durant, Rep. For. Brunei p. 43 (1933). Plate XXVII.

Species nova sectioni *Anthoshoreae* affinis, sed omnibus speciebus ramulis crassis ferrugineo-lepidotis, foliis magnis ochraceo-lepidotis, bracteis bracteolisque magnis persistentibus, fructu alis subauriculatis facile distinguenda.

Branchlets thick, terete, ferruginous furfuraceous when young, later cinereous. *Leaves* oblong and elliptic-oblong, shortly blunt-acuminate at the apex, cordate at the base,

averaging about 21.0 cm. $\times$ 12.0 cm. but may be considerably larger, coriaceous, glabrous and pale yellow-or brown-glaucous above, bright ochraceous to ferruginous lepidote beneath; midrib depressed above, elevate, striate, lepidote, and thick at the base beneath; main nerves about 30 to 36 pairs, inconspicuous above, elevate beneath; nervules joining the main nerves in numerous parallel lines, obscure above, subobscure or distinct beneath; petioles 2.0–3.0 cm. long, thick, scabrous, sparsely ochraceous-ferruginous lepidote; stipules oblong, subfalcate, about 1.5 cm. $\times$ 0.6 cm., ferruginous lepidote, caducous. *Panicles* terminal and axillary towards the ends of the branchlets, solitary, 6.0–14.0 cm. long, ferruginous-ochraceous lepidote to stellate-tomentose; peduncles 2.0–3.0 cm. long, bracteate; branchlets 5 to 8, regularly alternating, 1.0–2.0 cm. apart, racemose, each subtended by large, papyraceous, stellate-hairy, persistent, foliolar (sometimes absent) and stipular bracts. *Flowers* about 6 per branchlet, each subtended and embraced by large papyraceous, stellate-hairy, stipular bracteoles; mature bud about 14.0 mm. long (including the pedicel); pedicel 1.5 mm. long, stellate-tomentose. *Sepals* dense pale stellate-tomentose outside and puberulous towards the apex inside; three ovate-lanceolate, rounded at the apex, cordate at the base; two ovate-acuminate, slightly shorter, thin at the edges. *Petals* elliptice-ovate, tomentose outside on the portion exposed in bud, sparsely puberulous inside and on the remaining portion outside. *Stamens* 15, of three lengths, pairs alternating with single stamens; filaments linear, flattened, slightly narrowed above; anthers oblong, about two thirds to as long as the filaments, posterior cells smaller than the anterior; appendage to connective awl-shaped, recurved, about as long as the anther. *Ovary* ovate-conical, tapering gradually to the style, silvery pilose (except at the base); style cylindrical, longer than the ovary, silvery hairy (except for a short glabrous apical portion); stigma minute, obscurely, minutely (sometimes 3-) notched. *Fruit*—a 5-winged nut: stalk 4.0–5.0 mm. long, stellate-hairy; calyx lobes free almost to the base, but appressed to, and obscuring, the lower half of the nut; three outer calyx lobes linear-oblong, rounded at the apex, subauriculate at the base, about 8.0 cm. $\times$ 1.4 cm., puberulous on the free portions, densely ochraceous-pilose outside at the base, 9 to 11-nerved; two inner lobes broad and embracing the lower portion of the nut at the base, narrow and long-acuminate in the free portion, usually unequal, the longest up to about 3.0 cm., few-nerved, similar to the large lobes in texture; nut ovate-conical, rostellate, about 1.3 cm. long, densely ochraceous-pilose; rostellum about 0.5 cm. long, hairy except at the apex (frequently broken off).



Shorea scabrida Sym.

Shorea ochracea has many of the characters typical of the section *Anthoshorea* and I have little hesitation in referring it to that group. The large leaves, the thick branchlets, the ferruginous-ochraceous scurfy tomentum, the large, persistent bracts and bracteoles of the inflorescence, and the rather unusual subauriculate wings on the fruit, make this a very distinct and easily-recognizable species.

Collections examined:—

SARAWAK: For. Dept. Sar. 167 (TYPE of flower of *S. ochracea* Sym.); B. J. C. Spurway; Mirirai, Balleh, hill forest; 27th Nov. 1933; flower. Field note—vern. name, "*ruruk*", tree 90 feet high, 5 feet girth.

BRUNEI: C.F. 30363 (TYPE of fruit of *S. ochracea* Sym.); Abang Bujang; Sungei Keduan, hill side; 25th Nov. 1934; fruit. Field note—vern. name, "*lon* (Sarawak name)", tree 140 feet high, 156 in. girth, flower yellowish (probably this refers to the bracts. C.F.S.), fruit small, 3-winged.

C.F. 28712, 30612, & 39603.

BRITISH NORTH BORNEO: For. Dept. No. 67 (Villamil).

This species was first collected by Villamil in British North Borneo in 1915. Additional collections (including flower and fruit) from Sarawak and Brunei have made it possible to describe the species. The name *Shorea ochracea* is here given to it. The timber appears to belong to our "white meranti" class. As yet we know little concerning the abundance of the tree but it is evidently quite widely distributed on low hills or undulating land. The vernacular names *lon*, *majau*, and *ruruk* have been recorded.

***Shorea scabrida* Symington, sp. nov.**

Species *S. Teysmannianae* Dyer, *S. leprosulae* Miq., *S. pavifoliae* Dyer, etc. affinis, foliis parvis, obovatis, infra scabridis distincta.

Branchlets ferruginous stellate-tomentose towards the tips, later becoming glabrescent, lenticellate, black, with decurrent-elevate lines. *Leaves* usually obovate, but may be oval to elliptic-oblong, rounded, retuse, or rarely blunt-acuminate, at the apex, acute to rounded at base, averaging about 6.0 cm. $\times$ 3.5 cm., glabrous (except on midrib and main nerves) and dull purple-brown to black above, shining light to dark brown and stellate-hairy on the nerves beneath; midrib depressed and tomentose above, elevate, striate, and furnished with coarse, tufted, stellate hairs beneath; main nerves about 9 to 12 pairs, slightly depressed and tomentose towards the midrib above, elevate and coarsely stellate-hairy

beneath; nervules joining the main nerves in wavy sub-parallel lines, fine (sometimes obscure) on both surfaces, with occasional stellate hairs on the lower surface; petioles 0.7–1.5 cm. long, ferruginous stellate-hairy to tomentose; stipules oblong, about 5.0 mm. $\times$ 2.5 mm., ferruginous stellate-tomentose outside, caducous. *Panicles* axillary and terminal, solitary, up to 8.0 cm. long, (usually shorter), occasionally compound but usually with about 8 regularly alternating branchlets, coarsely ferruginous stellate-hairy; peduncles short; branchlets about 0.7 cm. apart, simple or bifurcate, about 1.0 cm. long, furnished with 3 to 7 closely set distichous flowers. *Flowers* oblong-lanceolate, up to 8.0 mm. long in bud, sessile. *Sepals* densely tawny stellate-tomentose outside, glabrous inside; three ovate-obtuse; two broadly ovate, acute, slightly shorter than the others, thin at the edges. *Petals* oblique-oblong, fimbriate at the apex, pale villous on the portion exposed in bud, "white" (For. Dept. Sar. 171). *Stamens* 15, of three lengths, pairs alternating with single stamens; filaments broad, flattened, subgibbous at the base, gradually narrowing above, when mature 4 to 10 times as long as the anthers; anthers globular, cells subequal, appendage to connective as long as the anther (large inner row), 2 to 3 times as long (shorter outer rows), at first erect, latter curved and deflexed. *Ovary* and stylopodium elongate-conical, glabrous on the lower portion, finely tomentose above; style cylindrical, about half as long as the ovary with stylopodium, glabrous (except where it joins the stylopodium); stigma slightly enlarged, obscurely 3-lobed. *Fruit* unknown.

It is not possible to refer this species to any of the sections of the genus *Shorea* as they are at present defined. The species to which *Shorea scabrida* is closely allied have usually been referred to the sections *Pinanga* and *Mutica*. Among these species are *Shorea leprosula* Miq., *S. Teysmanniana* Dyer, *S. parvifolia* Dyer, *S. lepidota* (Korth.) Bl., *S. platycarpa* Heim, *S. rugosa* Heim., and many others. Collectively these species produce most of the red timber known in the Malay Peninsula as "red meranti". The most distinctive diagnostic character of *S. scabrida* is the small, obovate leaves, which, being sparsely furnished with large, stellate hairs on the veins on the lower surface, are rough to the touch yet comparatively glabrous in appearance.

Collections examined:—

SARAWAK: Haviland 2227 (Kew & Mus. Kuching), & s.n. 25th March 1893 (Mus. Kuching); For. Dept. Sar. 171 (TYPE of flower of *S. scabrida* Sym.) Md Yusop;

Bukit Lima Forest Reserve, swamp; 7th Feb. 1935; flower. Field note—vern. name, *perawan lop*, small tree 72 feet high, 4 feet girth, flower white.

BRUNEI: C.F. 30513, 30552, & 30619.

Shorea scabrida, which is here described, was first collected by Haviland in 1892. Several additional collections have recently been made by forest officers in Sarawak and Brunei, where the tree appears to occur on coastal hills. Mr. Smith reports that the bark is like *meranti tembaga* (*Shorea leprosula*). These species are, actually, closely related botanically, and one would expect to find that, like *Shorea leprosula*, *Shorea scabrida* produces timber of the "red meranti" class. The only vernacular name so far recorded for *S. scabrida* is *meraka telor* (Kedayan).

Explanation of Plates

- Plate XVI. *Shorea guiso* (Blco.) Bl. 1, flowering twig. 2, twig with immature fruits. 3, twig with mature fruit. 4, mature flower bud. 5, expanding flower. 6 & 7, petal from mature flower. 8 to 12, sepals. 13, ovary—sepals & petals removed. 14, style & stigma. 15, longitudinal section through ovary. 16–24, stamens. (Drawings of 1 & flower parts based mainly on C.F. 17788; 2 on C.F. 8334; and 3 on C.F. 9508). *Scale applies to 1, 2, & 3 only.*
- Plate XVII. *Shorea ochrophloia* E. J. S. ex Sym. 1, sterile twig. 2, flowering twig. 3, ripe fruit. 4, flower bud. 5, expanded flower. 6 & 7, petal from expanded flower. 8–12, sepals. 13, ovary—sepals & petals removed. 14, longitudinal section through ovary. 15 to 19, stamens. (1 & 3 based on C.F. 29016; 2 & flower parts on C.F. 27482). *Scale applies to 1, 2, & 3 only.*
- Plate XVIII. *Shorea collina* Ridl. 1, flowering twig. 2, leaf showing cordate base. 3, 4, & 5, mature fruits. 6, expanded flower. 7 & 8, petal from expanded flower. 9, 10, & 11, large sepals. 12 & 13, smaller sepals. 14, ovary. 15, section through ovary. 16, stigma. 17, 18, 19, 20, & 21, stamens. (Flower drawings based on C.F. 319; fruit on C.F. 9509 & 29336). *Scale applies to 1–5 only.*
- Plate XIX. *Shorea Foxworthyi* Sym. 1, flowering twig. 2, ripe fruit. 3, mature flower. 4 & 5, inner sepals. 6, 7 & 8, outer sepals. 9, petal from mature flower (posterior). 10, petal (anterior). 11, ovary—sepals & petals removed. 12, 13, 14, & 15, mature stamens. 16, long. section through ovary. 17, end of style & stigma. 18, cross-section of ovary. (Flower drawings based on C.F. 30301; fruit on C.F. 28804). *Scale applies to 1 & 2 only.*
- Plate XX. *Hopea Helfer* (Dyer) Brandis. 1, flowering twig. 2, cordate leaf from sapling. 3, mature fruits. 4 & 5, immature fruits. 6, expanded flower. 7 & 8, flower buds. 9 & 10, thick outer sepals. 11, 12, & 13, inner sepals. 14 & 15, petal. 16, ovary. 17, longitudinal section through ovary. 18 & 19, stamens. (1 & drawings of flower parts based on Maymyo 7605 (F. No. 1929); 5 on C.F. 21462). *Scale applies to 1–5 only.*

- Plate XXI. **Hopea apiculata** Sym. 1, flowering twig. 2, panicle with immature fruits. 3, expanding flower. 4, flower bud. 5 & 6, petal from expanded flower. 7, 8, & 9, inner sepals. 10 & 11, outer sepals. 12, ovary. 13 & 14, stamens. 15, stigma (1 and drawing of flower parts based on C.F. 30322; 2 on C.F. 39105). *Scale applies to 1 & 2 only.*
- Plate XXII. **Hopea apiculata** Sym. 1, 2, & 3, mature fruits. 4, 5, 6, & 7, embryo removed from pericarp. 8, pericarp split on germination. 9, embryo just before germination. 10, embryo—germination commenced. 11, placenta. 12–18; stages in germination; 12 & 13=3 days after sowing, 14=4 days, 15=9 days, 16 & 17=17 days, and 18=81 days. (Drawings authenticated by C.F. 39106). *Scale applies to all except 18 which is $\times \frac{1}{2}$.*
- Plate XXIII. **Hopea resinosa** Sym. 1 & 2, flowering twigs. 3, flower. 4, flower bud. 5 & 6, petals from mature bud. 7, 8, & 9, outer sepals. 10 & 11, inner sepals. 12, ovary and stamens. 13, ovary—perianth and stamens removed. 14, stigma seen from above. 15 & 16, stamens. 17, mature fruit with resinous coating. 18, mature fruit—resinous coating removed. 19, 18 seen from above. 20, 18 with accrescent sepals removed. 21, pericarp dissected to show mode of splitting on germination. 22, 24, 25, & 26, embryo. 23, placenta. (Drawings of flowering twigs and flower parts based on C.F. 17193; fruit & embryo on C.F. 3602). *Scale applies to 1, 2, & 17 only.*
- Plate XXIV. **Shorea bentongensis** Foxw. 1, flowering twig. 2, twig with young inflorescence. 3, branchlet of inflorescence from 2—flowers removed (showing bracteoles). 4, flower bud. 5, 6, & 7, outer sepals. 8 & 9, inner sepals. 10 & 11, petal. 12 & 13, stamens. 14, appendage (highly magnified). 15, ovary. 16, 17, & 18, stigmas. 19, twig with immature fruits. (1 and drawings of flower parts based on C.F. 26215; 2 on C.F. 15774; 19 on C.F. 26505). *Scale applies to 1, 2, & 19 only.*
- Plate XXV. **Shorea inaequilateralis** Sym. 1, flowering twig. 2, stipule. 3 & 4, pair of bi-fid bracts from inflorescence. 9, mature flower bud. 10, 11, & 12, outer sepals. 13 & 14, inner sepals. 15 & 16, petal. 17, 18, & 19, stamens. 20, tip of appendage highly magnified. 21, ovary. 22, immature fruit. 23, mature fruit. (Drawings of twig & flower parts based on C.F. 30351; 22 on C.F. 30358; 23 on For. Dept. Sar. 153). *Scale applies to 1, 22, & 23 only.*
- Plate XXVI. **Shorea albida** Sym. 1, flowering twig. 2, flower bud. 3, 4, & 5, outer sepals. 6 & 7, inner sepals. 8 & 9, petal. 10, 11, 12, & 13, stamens. 14, abnormal stamen. 15, appendage to connective highly magnified. 16, ovary. 17, stigma. (Drawing of flowering twig and flower parts based on C.F. 30353; fruits on For. Dept. Sar. 154). *Scale applies to 1, 18, & 19 only.*
- Plate XXVII. **Shorea ochracea** Sym. 1, flowering twig. 2, ultimate branchlet—bracteoles removed. 3, bract from peduncle. 4, 5, 6, 7, 8, & 9, bracteoles removed in ascending order from the branchlet. 10, flower bud. 11, 12, & 13, outer sepals. 14 & 15, inner sepals. 16 & 17, petal from mature bud. 18 & 19, stamens. 20, ovary with 3 stamens remaining attached. 21 & 22, stigmas. 23 & 24, mature fruits. (Drawings of twig & flower parts based on For. Dept. Sar. 167; fruits on C.F. 30363). *Scale applies to 1, 23, & 24 only.*
- Plate XXVIII. **Shorea scabrida** Sym. 1, flowering twig. 2, 3, & 4, outer sepals. 5, & 6, inner sepals. 7, flower bud. 8 & 9, petal. 10 & 11, stamens from young bud. 12, mature bud—sepals and petals removed. 13, ovary. 14, section through ovary. 15, stigma. (Drawings based on For. Dept. Sar. 171). *Scale applies to 1 only.*

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